

CALIFORNIA ENERGY COMMISSION

# BLUEPRINT

EFFICIENCY AND RENEWABLE ENERGY DIVISION

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## Residential Radiant Barrier Compliance for the *2008 Building Energy Efficiency Standards*

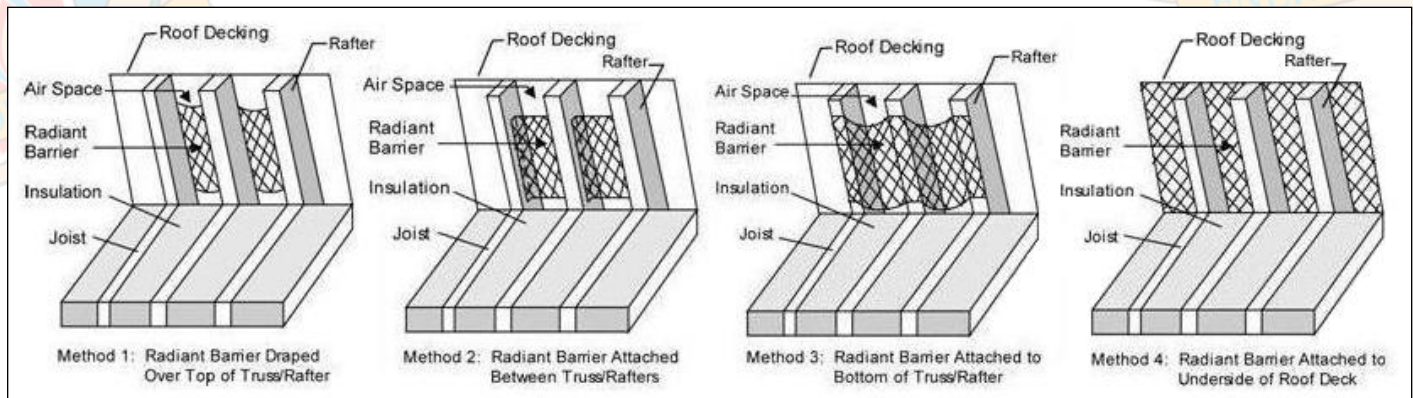
This article will clarify various performance parameters and provide compliance guidance when using radiant barriers in new or existing residential buildings to comply with the *2008 Building Energy Efficiency Standards (Standards)*.

Performance and installation criteria and general compliance guidelines for radiant barriers are addressed in the *2008 Residential Compliance Manual* (Section 3.3.3), the *2008 Reference Appendices* (Section 4.2.2), and to some degree in the *2008 Residential Alternative Calculation Method Approval Manual* (Section 3.4.3 and Tables R3-7 and R3-11).

- 1. Installation criteria** contained in these documents apply to new buildings, additions to existing buildings with roofs/attics of wood or steel framing, and enclosed rafter spaces of wood or steel framing such as vaulted/cathedral ceilings. For compliance with the *Standards*, a radiant barrier must:
  - a. Be certified by the California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (<http://www.bhfti.ca.gov/home.shtml>) and be listed in their *Consumer Guide and Directory of Certified Insulation Material*, at <http://www.bhfti.ca.gov/industry/tin-sulation.shtml>.
  - b. Have a tested emittance less than or equal to 0.05 per ASTM C1371 or ASTM E408.
  - c. Be installed in the upper portion of the building's truss/rafters, covering the entire roof/attic (including all gable ends), with the reflective surface facing down (towards the attic). Radiant barriers can be installed in any of four configurations, or any combination of these configurations (See Figure 1.):

- i) Draped over the top chord of the truss/rafters.
- ii) Fastened/stapled to the sides of the truss/rafters.
- iii) Fastened/stapled to the bottom of the truss/rafters, maintaining a minimum of 1 inch of air space between the radiant barrier and the bottom of the roof sheathing.
- iv) Laminated directly to the underside of the roof sheathing, perforated by the manufacturer to allow moisture/vapor transfer through the roof decking material.

Figure 1: Radiant Barrier Installation Methods



Source: California Energy Commission

NOTE: For enclosed attics and enclosed rafters (such as vaulted ceilings<sup>1</sup>) the California Building Code (CBC) requires a minimum of 1 inch of air space between the underside of the roof sheathing and the top of the insulation below, to prevent moisture buildup.<sup>2</sup>

- d. Have attic ventilation of no less than one square foot of vent area for every 150 square feet of attic floor area and have no less than 30% of the vent area located in the upper portion (at least 3 feet above eave or cornice vents) of the space being ventilated.<sup>3</sup>

NOTE: When the building has vaulted ceilings, each enclosed rafter space between framing members must be ventilated at the eave or cornice and the top of the roof ridge.

## 2. Showing compliance with the **Prescriptive Approach**:

All performance and installation criteria in "1." above must be met.

NOTE: When the building has vaulted ceilings, each enclosed rafter space between framing members must be ventilated at the eave or cornice and the top of the roof ridge. Minimum attic air

1. *Vaulted ceiling* - Also referred to as a *cathedral ceiling*, a high open ceiling formed by finishing exposed roof rafters; the ceiling follows the pitch or angle of the roof.
2. 2007 CBC, Section 1203.2
3. NOTE: 2007 CBC, Section 1203.2 requires a minimum of 50% of the required ventilators to be located in the upper ventilated area. Check with your local building department to insure the proper method of compliance.

ventilation is 1/150 (one square inch of net free ventilation for every 150 square inches of attic floor area).

### 3. Showing compliance with the **Performance Approach**:

All performance and installation criteria in “1.” above must be met, *except* that modeling of the proposed building’s attic ventilation may be reduced based on the CBC’s allowed requirements or by the local building official.

Changes made for the *Standards* allow the user to directly input into the computer program the presence of a radiant barrier and parameters of the proposed building’s total attic ventilation area and proportion of high vents. For this situation, any changes in the proposed building’s ventilation parameters that are different from the “standard design” building’s assumed values from Package D may require energy efficiency improvements elsewhere in the proposed building.

NOTE: When the building has vaulted ceilings, each enclosed rafter space must be ventilated at the eave or cornice and at the top of the roof ridge, dependent on the ventilation scheme (such as 1/150 or 1/300) allowed by the CBC<sup>3</sup> and/or by the building official. Energy credit for radiant barriers *may not* be taken for unventilated attics or unventilated rafter roof designs.

For modeling roof areas that cannot be ventilated, such as some vaulted rafter designs, there are two modeling options: (1) model the entire building as a single zone with no radiant barrier, or (2) model the ventilated and unventilated roof areas as two separate zones, following the computer program’s modeling guidance for assigning opaque assemblies, fenestration, and so forth to each zone, with the unventilated roof zone as having no radiant barrier.

Best practice for a radiant barrier ensures that it “sees” the roof above and attic below. Providing ventilation above and below the radiant barrier, such as a minimum of 3.5 inches between the radiant barrier and insulation below and a minimum of 6 inches (measured horizontally) at the roof’s peak, allows hot air to escape from each side of the radiant barrier’s surface.

## Efficiency Requirements for Water Chilling Packages: Clarification of Table 112-D

Table 112-D (*Water Chilling Packages – Minimum Efficiency Requirements*) of the 2008 *Building Energy Efficiency Standards* has caused some confusion. Specifically, electrically operated, air-cooled water chilling packages with condensers are divided into those with a capacity less than 150 tons and those with a capacity equal to or greater than 150 tons, without a corresponding division in efficiency requirements. This division should not have been made. All capacities of electrically operated, air-cooled water chilling packages with condensers must meet the listed efficiencies of 2.80 COP and 3.05 IPLV.

## Guidelines for Residential HERS Compliance Documentation Registered on or After October 1, 2010 – Newly Constructed Buildings and Additions

Starting January 1, 2010, the *2008 Building Energy Efficiency Standards* required all compliance documentation for newly constructed low-rise residential buildings requiring HERS verification and demonstrating compliance under the multiple orientation alternative to be registered with the appropriate HERS Provider. On October 1, 2010, this requirement was extended to all low-rise residential buildings requiring HERS field verification.

To ensure compliance with this regulation, please follow these guidelines for newly constructed dwellings and additions:

- Look for and review a registered Certificate(s) of Compliance (CF-1R) submitted with the building plans. A registered CF-1R will have a HERS Provider's watermark and a unique 12-digit registration number followed by 13 zeros located at the bottom of each page.\*
- Look for and review an electronically signed and registered Installation Certificate(s) (CF-6R)\* posted by the installing contractor at the building site. The first 12 digits of its 21-digit registration number (followed by four zeros) will match the associated CF-1R's registration number.
- At final inspection, look for and review an electronically signed and registered Certificate(s) of Field Verification and Diagnostic Testing (CF-4R) posted at the building site by a certified HERS rater. The first 20 digits of its 25-digit registration number will match the associated CF-1R's registration number.
- At final inspection, verify that the work listed on the CF-1R has actually been completed and that the installed equipment matches what is listed on the CF-6R posted at the building site.
- You may verify that any registered compliance document is valid by searching for it on the appropriate HERS Provider's website using the document's registration number. (Currently CalCERTS [[www.calcerts.com](http://www.calcerts.com)] is the only HERS Provider certified for newly constructed residential buildings and additions.) If the submitted CF-1R, 6R, or 4R does not exactly match the version posted on the provider's website, or if there is no electronic version available, its validity should be questioned.

\*Visit [www.energy.ca.gov/title24/toolkit](http://www.energy.ca.gov/title24/toolkit) for a Registration Number Guide and an example registered CF-6R.

Continued on next page.



## Guidelines for Residential HERS Compliance Documentation Registered on or After October 1, 2010 – HVAC Alterations

Starting October 1, 2010, all required energy compliance forms for residential HVAC alterations shall be registered with an approved HERS provider when HERS field verification and/or testing is required. This will include the CF-1R-ALT-HVAC form (or CF-1R-ALT form), all required CF-6R-MECH-HERS forms, and all required CF-4R forms. To help simplify verification that all of these forms are registered when required, please follow these guidelines:

- The CF-1R-ALT-HVAC form (or CF-1R-ALT form) shall be completed by hand, signed, and submitted along with the building permit application by the individual applying for the permit. This form will not be registered at the time of permit application.
- For the final inspection, the building inspector shall verify that the following energy compliance forms are completed and signed by the installing contractor (or homeowner if the homeowner installed the HVAC equipment and/or ducting), and that the forms are registered by an approved HERS provider:
  - CF-1R-ALT-HVAC form (or CF-1R-ALT form)
  - ALL required CF-6R-MECH-HERS forms
  - ALL required CF-4R forms

*NOTE:* The CF-1R-ALT-HVAC form identifies which CF-6R-MECH-HERS forms and CF-4R forms are required depending on climate zone and the type of HVAC alteration.

- After the final inspection, the installing contractor shall provide a copy of the registered energy compliance forms to the homeowner.

### **HERS Providers currently approved for alterations:**

CalCERTS – [www.calcerts.com](http://www.calcerts.com)

CBPCA – <http://thebpca.org>

For more information regarding residential HVAC alterations, required energy compliance forms, or the registration of forms, please visit the newly developed 2008 Energy Standards Online Learning Center at [www.energyvideos.com](http://www.energyvideos.com), or contact the Energy Standards Hotline at (800) 772-3300.

## Attention Energy Professionals: The California Energy Commission Is Hiring!

The California Energy Commission is testing and hiring for several professional-level positions. Please visit the Energy Commission's careers page at <http://www.energy.ca.gov/careers/index.html> to find out about the exam and hiring process and view openings.

### Building Energy Efficiency Standards Training

Please visit the Energy Commission's **Online Learning Center** at

[www.title24learning.com](http://www.title24learning.com)

For training offered by utilities and others, please visit the following websites:

Pacific Gas and Electric Company

[www.pge.com/mybusiness/edusafety/training/pec/classes/](http://www.pge.com/mybusiness/edusafety/training/pec/classes/)

Southern California Gas Company

<http://seminars.socalgas.com>

San Diego Gas & Electric Company

<http://seminars.sdge.com>

Southern California Edison

[www.sce.com/b-sb/energy-centers/workshops-classes.htm](http://www.sce.com/b-sb/energy-centers/workshops-classes.htm)

Sacramento Municipal Utility District

[www.smud.org/en/education-safety/](http://www.smud.org/en/education-safety/)

California Building Officials

[www.calbo.org](http://www.calbo.org)

California Association of Building Energy Consultants

[http://cabec.org/cepe2008standardsinfo\\_2010.php](http://cabec.org/cepe2008standardsinfo_2010.php)



Flex Your Power News

[www.fypower.org/news](http://www.fypower.org/news)



[www.gosolarcalifornia.org](http://www.gosolarcalifornia.org)

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## BLUEPRINT

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**Need Help?**

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